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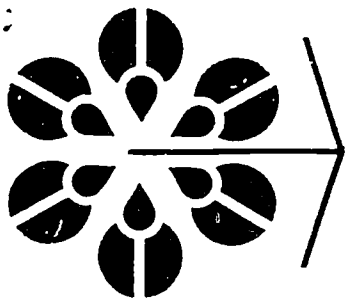
ABSTRACT

A model is outlined that generates program costs and indicates the relative contribution of the various dimensions of a program to costs. The model says that there is no direct relationship between costs and learning, but that program (and school) parameters intervene. Some of these parameters have costs associated with them, but these are not necessarily salient in predicting learning differences. The model, still incomplete, indicates relationships among cost-related parameters and shows how program costs may be generated or predicted from them. (Author)



research for action

A MODEL FOR DETERMINING COSTS OF SCHOOL PROGRAMS

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This paper describes a model for costing educational programs and the educational system within which they occur in a way that allows determination of the total costs of a student program and of the relative contribution of certain dimensions of the program which are subject to control by educators. At present the model is incomplete in detail, but it provides the capacity for delineating the major costs of programs at the school level. Although the method is independent of the objectives of the program, it produces program costs which are adequate for cost/benefit analysis where benefits of a program have been or can be measured.

The development of this technology was begun in the Province of Ontario, Canada, in connection with research on programs teaching French as a second language. In 1973 a number of experimental projects for French teaching were introduced in the National Capital region. Associated with these programs was a large evaluative research effort funded by the Ontario Ministry of Education, a part of which was directed at examining the costs associated with the experimental programs.[1]

The first part of the paper will discuss two popular approaches to cost benefit analysis. It will then proceed to examine the reasons for the (alleged) failure of these approaches and to propose an alternate plan or model for costing programs. Finally, use of the model will be demonstrated. It should be noted that this paper presents an outline of the model and is not a fully detailed explication.

Two Approaches to costing

Studies in the field of educational costs seem to be of two types. One uses production functions to relate measured inputs to measured outputs. The other is management-oriented and attempts to relate program objectives and school budgets.

The production functions use regression techniques to relate inputs to outputs. The techniques, which have a long history in economics, became popular in educational research with studies of equality of educational opportunity in the United States.[2] "When these techniques are successful it is possible to estimate changes in levels of the different outputs that will result from a change in the level of a given input."[3] However, they have not been overly successful.[4]

Outputs have generally been measured by standardized tests of cognitive achievement or by output levels such as years of schooling.[5] What is to be explained in most of these studies, is not level of cognitive achievement or even student change in cognitive measures, but variations in student achievement or student change among schools or school districts.

Similarly, the independent variable is variation in inputs among schools or districts. Measurement of inputs have included both costable and non-costable resources. Most prominent of the non-costable resources are a variety of student characteristics including ability, socio-economic status variables (parental occupation and education, family income), race, neighbourhood housing values, and peer group influences. These have generally been found to explain the largest proportion of outcome variation.[6]

School variables also may include non-costable inputs, such as teacher quality as measured by principals' ratings or verbal ability, and school district size.[7] Other inputs are technically cost related, but not practically costable, such as age of buildings. Costable school inputs typically include teacher salary levels, teachers' education and experience, class size, pupil-teacher ratio, pupil-administration ratio, number of library volumes per student, and gross measures of dollar input such as per pupil expenditure. These variables are sometimes considered as proxy measures for 'quality of education'.

School related variables typically do not explain nearly as much of the variance as student variables, and furthermore they are not reliably related to outcomes across studies: those inputs found significant in one study are not found significant in another.[8]

Traditionally, failure of the production functions to link input and output consistently have been blamed on incorrect specification of inputs, outputs, or both.[9] This tradition has been carried on in education, and successive studies have sought to improve the quality or quantity of factors in the function. Output measures are most generally criticized for not including non-cognitive measures. The criticisms of inputs have more variety. Lack of inclusiveness, uncontrolled interaction between pupil characteristics (especially SES) and other inputs, and measurement problems, especially of 'quality' of education, are all cited as reasons for failure of school variables to explain more variance. The level of analysis--whether the variance occurs among children, among classrooms, among schools, or among school districts--is also cited as a factor in the lack of results.

All of these problems (with the possible exception of measurement) may be seen as representative of a deeper kind of lack of 'specification' which is probably inherent in the nature of production function analysis. Production functions seek to link input and output without examining process. Schools are simply black boxes where inputs turn into outputs. Student characteristics, teacher experience, age of buildings, dollars, and books in the libraries are expected to turn into learning outcomes in some unexplained way.

Another orientation to cost and quality concerns is cost-benefit analysis, program planning and budgeting systems (PPBS), and an array of similar accountability and management-by-objectives procedures.[10] This literature is light years away from that which uses the regression techniques of production functions.

The production function studies are in the tradition of 'scientific' investigation in social science where data is obtained about certain variables from a specified sample. The objectives-budgeting literature is in the how-to tradition, where a case study or a hypothetical case provides data which is used to show how it should be done. Production function studies are generally 'macro' in orientation, concerned with education as a societal function. Objectives-budgeting studies are oriented to the management of school districts--the 'micro' level.

Production function studies accept standardized tests of some sort as measures of output (albeit with apologies). Objectives-budgeting begins with the specification of objectives, often in bitty detail. These procedures demand that objectives be stated "in measurable and behavioral terms."[11]

In fact, they are often stated in terms of the percent of students who achieve correct responses to specific test items, thus building the testing instruments into the goal specification. "The actual process of goals determination has proved to be a bothersome and time consuming chore"[12] and, indeed, the accountability literature scarcely gets beyond this point.

Finally, where input-output analysis has an accepted technique, regression analysis, for linking output and input, objectives-budgeting procedures rely on the ability of educators and finance officers to redefine and divide accounting categories to allow separation of expenditure for each program. The books provide guidance, in the form of examples, on how this should be done, but it remains more of an art than a technology.

Wildavsky argues that "no one knows how to do PPBS," and gives several reasons.[13] There is the problem of determining the limits of a program and of assigning support service costs to the various programs they serve. The defining of benefits runs into two problems--what are the benefits and drawbacks, and to whom do they accrue. In sum:

> The reason for the difficulty is that telling an agency to adopt program budgeting means telling it to find better policies and there is no formula for doing that. One can (and should) talk about measuring effectiveness, estimating costs, and comparing alternatives, but that is a far cry from being able to take the creative leap of formulating a better policy.[14]

Despite the many dissimilarities between input-output analysis and objectives-budgeting, they are similar in that neither is much concerned with the internal features of the system, the black box within which money is transformed into learning outcomes. Both posit some direct relationship between costs and benefits. Input-output analysis assumes that if system features are important in determining output, this will be shown

by failure of the functions to allow prediction. In the educational use of the model some of these system features (e.g., class size) have been included as inputs. Objectives-budgeting procedures assume that the educator-manager understands the operation of the system well enough to know what adjustments should be made if the analysis indicates that the cost-benefit ratios are out of line.

Parameters and Costing

Accounting approaches to costing involve setting up a subcategory for each program in the budget or code of accounts and then allocating expenditures for salaries, instructional materials, text, etc., to the appropriate program subcategory within that account. To obtain the cost of a program, the expenditures for the program subcategory in each account are added together. Usually these total costs are divided by the number of pupils taking the program to get the program cost on a per pupil basis.

The problem with these techniques is that they tacitly assume that 'the program' incurs costs as a single entity or, in other words, that 'the cost of a program' is an intrinsic property of the program.

In fact, costs are incurred by the school system in the process of providing the program to the students. Costs are not intrinsic to a program, but depend on choices made about the personnel and their utilization, learning materials, classroom space, class size, administrative curriculum development needs, location, bussing, etc. Different choices about any one of these resources would lead to different program costs. Furthermore, because programs usually share some resources (e.g., the same school building,

or a specialist teacher for one subject), the costs of offering one program will depend in part on the other programs sharing the same resources.[15]

The program cost analysis model begins with the school system. It posits that the school system intervenes between costs and learning outputs and significantly modifies the relationship between them. No matter how well 'specified' are inputs and outputs, it will be found that the relationship between them cannot be determined without specifying the parameters of the school system which turns inputs into outputs. Anything that happens in a school, and even the building design itself, may have an effect on students and their learning.

Acknowledging that schools and school programs are not monolithic entities, the cost analysis model says that they may be described by a number of parameters. Each parameter is one of the set of properties whose values define the characteristics of the program and the school milieu. There are a very large number of such parameters, and, indeed, a taxonomy of parameters would indicate not only major categories, but also that the parameters could be specified in finer and finer detail.

Some parameters are consciously chosen by school boards, principals, teachers and curriculum designers as part of a rational, goal-oriented, decision making process. The goals are the objectives of the school for the children. Usually they will be program goals for (more or less) specific cognitive learning for children in the program, but they may be non-cognitive goals and/or general to all programs. In any case the parameters are properties of the means taken to reach these goals.

Other parameters are related to the organizational needs of the school. These may be scarcely 'chosen' at all. They may be 'the way things are done around here', compromises among personalities, or spinoffs from other decisions and the constraints they impose. These parameters characterize the organizational structure of schools and the way program information is delivered to students. Even when such parameter values are chosen the goals may have more to do with teacher morale or administrative efficiency than with student learning.

Another vector of influence on parameter values comes from the fact that schools are socializing agents. Many parameter values are as they are because that is the way things 'are done' in the society. The strongest influence of these (often subconscious) beliefs about such things as fairness, competition and equality will probably be on the content of the school and program messages, but there may be more direct effects on costs. For example, 'comfortable' building temperatures are related to both social habits and costs.

The parameters are related to one another in groups: There are sets of parameters related to providing classrooms (e.g., floor space, desks or tables) and the school plant facilities (building design and spacial relationships of classrooms, corridors and library). Other sets are related to the administration of the school (frequency of principal's classroom visits, type of intercom between classroom and office), and the providing of general services like the school nurse or library services (hours of operation, access procedures). Parameters of this type will be called milieu parameters. They describe properties of the school, or school system which affect all or most programs at a school rather than characterizing a specific program. Milieu parameters

will not be discussed here because the model is not yet developed that far.

The program parameters are properties of specific programs, in that they carry part of the informational message of that program. Some illustrative examples of program parameters are:

Subjects and the subject content to be included
Allocation of student time among various subjects
Sequencing of subject topics (e.g., per cents, decimals, fractions)
Textbook and other pedagogical materials
Extent to which students can work independently with materials
Selection criteria for enrolment (e.g., age, ability, or interest)
Class size
Criteria for assigning student to classes
Evaluation and feedback techniques

There are many others.

The process of instituting a program in the school is the selection of the value which the program will take on each parameter. Decisions about parameter values tend to follow the school hierarchy. The board and senior administrators specify value ranges of major parameters. Detailed implementation of these decisions takes place through parameter choices within these ranges at the school or classroom level. Such choices may be made as part of processes in which means are selected to reach certain learning objectives or they may be made for other reasons (often having to do with organizational requirements or ends). The costing model does not assume that the creation of a program is an intentional, rational, or goal-oriented process.[16]

The cost analysis model makes four major assumptions:

1. Every program has a value on each parameter. (The value may, of course, be zero in some cases.) It will be offered to students of some age and ability levels, organized into classes of some size, taught by some kind of teachers using some curricular material, etc. It should be noted that the parameters are inter-connected so that location on one may limit the range of location on another.

2. Only some parameters incur costs, either directly or because costs are determined by a function relating two or more parameters. Other parameters are not related to costs and choices about them may be changed without affecting costs (e.g., sequencing of subject topics).

3. At least some, but not necessarily all, parameters affect learning outcomes.

4. It may not be assumed that the cost-relevant parameters are those most salient in determining effectiveness of programs. This is an empirical question.

The cost of a program will depend on the value it takes on each of the cost-related parameters. For example, one cost-relevant parameter is class size, the number of students in the group each teacher is responsible for. Ceteris paribus, the smaller the class size, the greater the cost. Thus, a decision to give the program to small classes, or to give a part of the program, say one subject, to small classes, will imply larger program costs. This relationship holds no matter what subjects are taught or what teaching style is used.

By determining what parameters have implications for costs and specifying the functions between costs and the cost-relevant parameters, it will be possible, not only to generate actual program costs, but to understand how the program incurs costs. The cost analysis model is the specification of the relationships between costs and the cost-relevant parameters of programs. The specification will usually take the form of a mathematical expression.

An Example

Let us look at a simple example which involves two program parameters: the size of classes to which the program is presented and the use or not of teacher's aides. Some boards, faced with large increases in teachers' salary scales, are asking whether costs can be cut by a combination of increased class

sizes and the use of paraprofessionals and teacher's aides.[17] We will not here discuss any of the pedagogical issues involved nor will we consider the effect on teacher work load or morale. The concern here is one of costs: 'By how much must class size be increased to justify, considering the dollar costs only, the use of paraprofessionals and teachers in the classroom?'

In elementary schools, students are usually divided into groups--classes--of students and a single certified teacher is usually given the prime responsibility for instructing this class, although a specialist in music or French may teach it for a brief period each day or the class may spend a half hour a week in the library. The teacher has, as a rule, responsibility for no other students. Therefore, her entire salary is charged to this class as part of the cost of its educational program. Whether the class is larger or smaller, the cost of its teacher will remain as a class cost.

If it is decided to have a paraprofessional assist this teacher, her salary, for the time she is in the class, will also be charged to this class. For instance, if the salary of the teaching aide is $5,000 and she assists a class for half of each school day, then she would add $2,500 to the cost of instructing that class. On a percentage basis, if the class teacher's salary is $10,000, the paraprofessional would add 25% to the basic teaching costs of the class.

If the increased cost of a paraprofessional is to be justified solely on cost considerations, class size must be increased to a greater proportion than the relative cost of the teacher's aide. That is, if, as in the case above, the teaching aide adds 25% to the basic teaching cost, class size must

be increased by more than 25% if any financial saving is to be made. If class size increases by exactly 25%, the per pupil cost will remain the same; if less than 25%, the costs will be greater with the teacher's aide. If the class size with no teaching aide were 25 and the question were whether to increase it to 30, the cost-rational decision would be "no". The class size increase would be only 20%, less than the 25% additional teaching cost.

The mathematical statement which must hold true for the use of paraprofessionals to be cost effective is:

$$\frac{T + A}{T} < \frac{Z_a}{Z_t}$$

where T = teacher's salary (including fringe benefits); A = aide's salary (including benefits); Z_a = class size expected for classes with aides; Z_t = class size expected for classes without aides.

However, even in this best of all possible worlds there is sometimes a fly in the ointment. In this case the 'fly' is the question of whether the larger class size can be reliably achieved and maintained in the program. Although guidelines for class size may be set by the board of trustees or senior administrators, actual class sizes are determined in the different schools of the system where the actual number of students must be divided up among classes according to the guidelines. If the enrolment at the school is not large enough to maintain the larger class size, the theoretical savings will not be realized. So, how can the administrator be sure that the larger class size can be realized? To answer that question, we will have to examine the relationship between enrolment and class size.

Class sizes will vary depending on how evenly the enrolment can be divided by the class size Z (putting aside for the moment the question of whether this is Z_a or Z_t). If the program is 1) to be offered only to classes of children who are at the same grade level (a parameter of the program); 2) the desired class size is 25 (another parameter); and 3) if the particular school has 75 students enrolled in the program at each grade, everything works out neatly. If, however, the enrolment drops to 60 the class size must go down to 20 or up to 30. If the initial enrolment was 150 (six classes of 25), and drops by fifteen to 135, the effect on class size will be much less, either six classes of 22 and 23; or five classes of 27. The better fit is not simply a function of the drop being a smaller proportion of the larger enrolment, but rather has to do with the relation of the number of classes to the remainder left when the enrolment is divided by the class size. When enrolments are large, the remainder is spread over more classes. (The remainder will be less then Z and usually less than $\pm\frac{Z}{2}$ since administrators accept classes both larger and smaller than the ideal.

In order to determine the size of enrolments necessary to achieve reasonable control of class size, the administrator must put numbers to the idea of 'reasonable'. That is, he must indicate not merely the desired class size, but also how much above and below that number he will consider reasonable. Then, the mathematical expression to determine the number of classes necessary to achieve reliable control of class size is:

$$B \geqslant \frac{S - 1 - L}{R}$$

where: S = optimum average class size
L = difference between the optimum average class size and the smallest acceptable average class size
R = difference between the largest and smallest acceptable average class sizes
B = the minimum number of classes and is the lowest integer that will satisfy the equation.

Knowing the minimum number of classes necessary to maintain reasonable class size, it is a simple matter to multiply that times the optimum class size and determine the enrolment level that is needed to operate efficiently with respect to class size. That is, where E = enrolment, E = B x S. These equations imply, of course, that the larger the desired class size, the larger the enrolment necessary to maintain it.[18]

To return to the cost of paraprofessionals and class size, it is fairly obvious that enrolments for the program at a school (and grade, if that is a program parameter) must be larger when an aide is to be used. That is, they must be large enough to maintain the larger class size in reality. If they are not, the theoretical savings will not materialize.[19]

This illustration has taken a rather uncomplicated situation and may seem more effort than it is worth to some administrators. The model has already been developed to examine the relationships among teacher instruction time, teacher's planning time, class size, program compositions and costs. Although the principles involved are fairly straightforward, the methodology is too complicated to present here. However, the model gives relative costs of teachers delivering each subject in a program as well as an actual total program cost. Another paper has begun the examination of transportation costs (bussing) to alternate school programs and we are now examining costing of instructional materials, program development and administration.

Delineation of Parameters

The purpose of the model is to enable administrators to understand the cost implications of the choices they make about programs. It can do this, or will be able to do this, either for existing programs or for programs or program modifications being planned.

At present much work remains to be done to complete the model, both in delineation of parameters and in specification of the relationships among them and with dollar costs. The total number of parameters will depend on how finely they are to be drawn, but there are certainly a very large number of properties of schools that are relevant to either costs or learning benefits or both. As has been noted, these can be grouped into interrelated sets pertaining to certain aspects of schools.

Initially, the distinction was made between parameters that describe particular programs and those that describe the school as a milieu or environment within which programs are offered. Milieu parameters can be subdivided into two large groups, one characterizing the facilities and physical space of the school, and the other describing the services supplied in support of the program. These services, in turn, fall into three categories: administrative support, services to students as individuals (e.g., health care), and services to the program and its teachers and students as partakers of the program (e.g., library services). At this time the only set of milieu parameters which have been examined are those describing bussing.

Program parameters have been more thoroughly examined. A program consists of information which the student is expected to learn. It is the curricula in various subject areas that the educational system has to impart to the student over a year or some other period of time. This body of knowledge can be assumed to exist independently of the school, but in order for it to become a school program, the information must be organized for presentation to the student. In the context of cost analysis, the program is an intangible. It

is different from, and more valuable than, the paper it is written on.

Program parameters are of two types, those that characterize the content, sequencing, and organization of the information for presentation to students, and those that characterize the process of delivering it to the student. Delivery parameters include teacher utilization--how much planning time, team teaching or one teacher/one class, use of specialists, and class size are specific dimensions--and the provision of textbooks, workbooks, dittos, and the like that carry the program information.

The lion's share of program costs have to do with program delivery. These are the ongoing costs of teachers, instructional aids and school supplies. Decisions about program delivery parameters may have direct cost consequences, as is the case of a decision to use a particular text, or they may affect costs indirectly or in combination with other parameters. A decision to use more experienced, and hence higher paid, teachers will not necessarily affect costs if the teachers instruct larger classes or have less planning time.

The costs of the program information have to do with the development of the program, and the training of teachers to use it. Many of these are initial costs of the program and may be thought of as purchasing intellectual capital for the program to draw on throughout its life. In addition, of course, some upgrading and revision of the curricula will have to be done from year to year.

From what we have seen so far in the schools we have investigated, relatively little is spent on the development of this intellectual capital, probably only a small fraction of the cost of the tangible capital of the system. Educators might well pay more attention to the program information parameters. It is not unreasonable to expect that choices about parameters characterizing

the content, sequencing, and manner of presentation of information might be the most salient decisions in determining learning outcomes. Furthermore, the cost of a program using one sequencing of topics or teaching style is probably not much different from that of another sequencing of subjects or another style. The selection of the most effective program information parameter value is likely to be the most cost effective one as well. On the other hand, program delivery parameters have large impacts on costs and the research that has looked at them indicate they are not salient in affecting learning outcomes. Up to a point, the least costly is likely to be the most cost effective.

Summary

There has been a call for school system accountability and for improvement in the quality of education. The cost analysis model discussed here is concerned with accounting for costs in terms of what is bought for the programs of the school. The model says that costs are not intrinsic to a program, but are incurred in relation to decisions made about how the program shall be organized and presented to students. The dimensions along which decisions are made are parameters. Each parameter is one of a set of properties whose values determine the characteristics of a program. The model rests on four basic assumptions:

1. Every program has a value on each parameter.
2. Only some parameters incur costs, either directly or because costs are a function of the interaction among parameters.
3. At least some, but not necessarily all, parameters affect learning.
4. It may not be assumed that the cost-relevant parameters are those most salient in determining effectiveness of programs.

The cost analysis model examines the school system and identifies the cost relevant parameters. It goes further, when it can, and specifies the

relationships among the parameters and between the parameters and costs. Such relationships were illustrated by the example of teacher's aides and class size.

In order to identify parameters, several areas of the school have been delineated. First, there are parameters describing the school milieu, the environment within which many programs might be given. Second, there are programs. Parameters characterizing the program may be divided into those pertaining to the content and organization of the information to be conveyed and others pertaining to the delivery of that information to the student. The organization of classes, teachers, the provision of texts and audio-visuals are included in delivery. The costs associated with program information are primarily initial costs of development, and the resulting curricula may be likened to capital goods. The major ongoing costs are related to program delivery. This delineation suggests that greater learning benefits may be related to program information parameters, while dollar savings would be more likely to come from altering program delivery parameters.

The cost analysis model provides a technique for determining costs of programs and identifying features of programs that are responsible for incurring these costs. It can be used to generate costs for use in cost-benefit analysis, where the benefits accruing from parameter choices can be evaluated through research.

NOTES

1. Halpern, G., et al.: Alternate school programs for French Language Learning. Toronto: Ontario Ministry of Education, 1976.

2. Colman, James S.: Equality of Educational Opportunity (Washington: Department of Health, Education, and Welfare, 1966); Averch, Harvey A., et al.: How Effective is Schooling? (Santa Monica, California: The Rand Corporation, 1972); Katzman, Martin T.: The Political Economy of Urban Schools (Cambridge, Mass.: Harvard University Press, 1971); Murnane, Richard J.: The Impact of School Resources on the Learning of Inner City Children (Cambridge, Mass.: Ballinger, 1975); Bidwell, C.E., and Kasarda, J.D.: "School District Organization and Student Achievement," American Sociological Review, 40:55-70 (1975); Stone, Richard: "A Model of the Educational System," Minerva, 1965 (Winter): 172-178.

3. Murnane, op. cit., 5.

4. Averch, op. cit., 40.

5. Ibid., 35.

6. Ibid., 45-46

7. School district size is also used as a proxy for economies of scale. See Katzman, op. cit. 88-89.

8. Averch, op. cit., 44-45.

9. Murnane, op. cit., 6.

10. Knezevich, Stephen J.: Program Budgeting (PPBS) (Berkley, California: McCutchan, 1973); Doherty, Victor, W.: "PPBES and school system evaluation" Mimeo, 1973, Portland, Oregon, Public Schools; Forbes, Roy H.: "Determining cost effectiveness in reading instruction" Final Report, 1975, U.S. Department of Health, Eduation, and Welfare; National Institute of Education, Project No. 3-2501; Levin, Melvin: "Yardsticks for Government: the role of PPBS," In Levin and Shank: Educational Investment in an Urban Society (New York: Teachers College Press, 1970).

11. Knezevich, op. cit., 50.

12, Ibid., 49.

13. Wildavsky, Aaron: "The Political economy of efficiency" Public Administration Review, 26(4): 292-310 (1966); "Rescuing policy analysis from PPBS", Public Administration Review, 29:182-202 (1970).

14. Wildavsky, Rescuing policy analysis from PPBS, op. cit., 290.

15. There is also a danger in using actual per pupil costs in that chance fluctuations in enrolment may distort them. For instance, if a teacher is paid $12,000 to teach a class of 25, the per pupil cost is $480. If one child leaves the class, the per pupil costs rise to $500.

16. This is a different point of view from the orientation expressed in "Program design and evaluative research." Halpern, G. MacNab, G.L., and Kirby, D.M. (FRENCH Working Paper No. 21, Research Centre, Ottawa Board of Education). Although the observer may see the choosing of values on the parameters as choices of means to reach goals, it is unlikely that the educator chooses all (or even most) of them with goals in mind. Indeed, for many of the parameters, the educator is probably not aware of alternatives among which to choose; they are simply the way-things-are. In other cases parameter values may be chosen because of organizational requirements rather than to reach learning goals. (See Katzman, op, cit., 78-85, for a discussion of organizational goals in this context). Even when the educator has explicit goals, these are often vague, and relevant information about the means to reach them is frequently lacking. Finally, earlier choices will limit later choices, since there are interactions among parameters within a program and between programs.

17. This paper restricts itself to the situation of one certified teacher to one class. It does not analyze the financial consequences of a form of differentiated staffing which would, for example, assign a paraprofessional to each of three classes and assign one "master teacher" to all three classrooms.

18. The matter is somewhat more complex than this in that the way the total school enrolment is defined as to grade level, program and other criteria for sorting students into classes will affect the enrolment necessary to maintain a given class size. Roughly, the more rigid the criteria, the larger the necessary enrolment. See MacNab: Factors affecting the control of class size. Research Report 74-09, Ottawa Board of Education Research Centre, 1974.

19. An alternative might be to have paraprofessionals available at the beginning of the year to go into any class large enough to need them. This plan has advantages, especially in jurisdictions where enrolments are not stable. A principal could always choose the larger class size and the smaller number of classes knowing that a teacher's aide would be available. The drawback is that knowing how to use an aide, teaching the aide the program and pedagogy necessary to be of help, and developing a 'team spirit' between the teacher and her aide takes time. Unless the arrangement lasts for two or more years it may not be worth the effort to the teacher.